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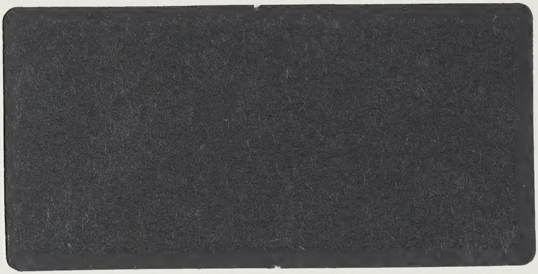
AN OVERVIEW OF THE
NORTHEASTERN REGION
FOREST LAND PRODUCTIVITY SURVEY
GROWTH AND YIELD PROGRAM

- EXECUTIVE SUMMARY -

CENTRAL ONTARIO FOREST
TECHNOLOGY DEVELOPMENT UNIT



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- EXECUTIVE SUMMARY -

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Technical Report No. 8
December 1989

EXECUTIVE SUMMARY

The Forest Land Productivity Survey (FLaPS) of the Northeastern Region, formally initiated in 1977, consists of a continuing inventory of the surficial deposits and soils in the NE Region and a forest yield survey based on stem analysis of mean basal area trees of well-stocked natural forest stands. The program was designed to separate the 'poor sites' from the 'intermediate' and 'good' sites at a regional scale within a four year maximum time frame. The growth and yield component was to quantify, in broad regional terms, the "productive" capacity of these site (soil) types by species.

The FLaPS program consisted of four distinct phases (Heikurinen and Kershaw 1986, p. 96):

1. the review of existing land inventories in the region and an assessment of their suitability as a regional data base (carried out by Mr. C. Benson, Faculty of Forestry, Lakehead University);

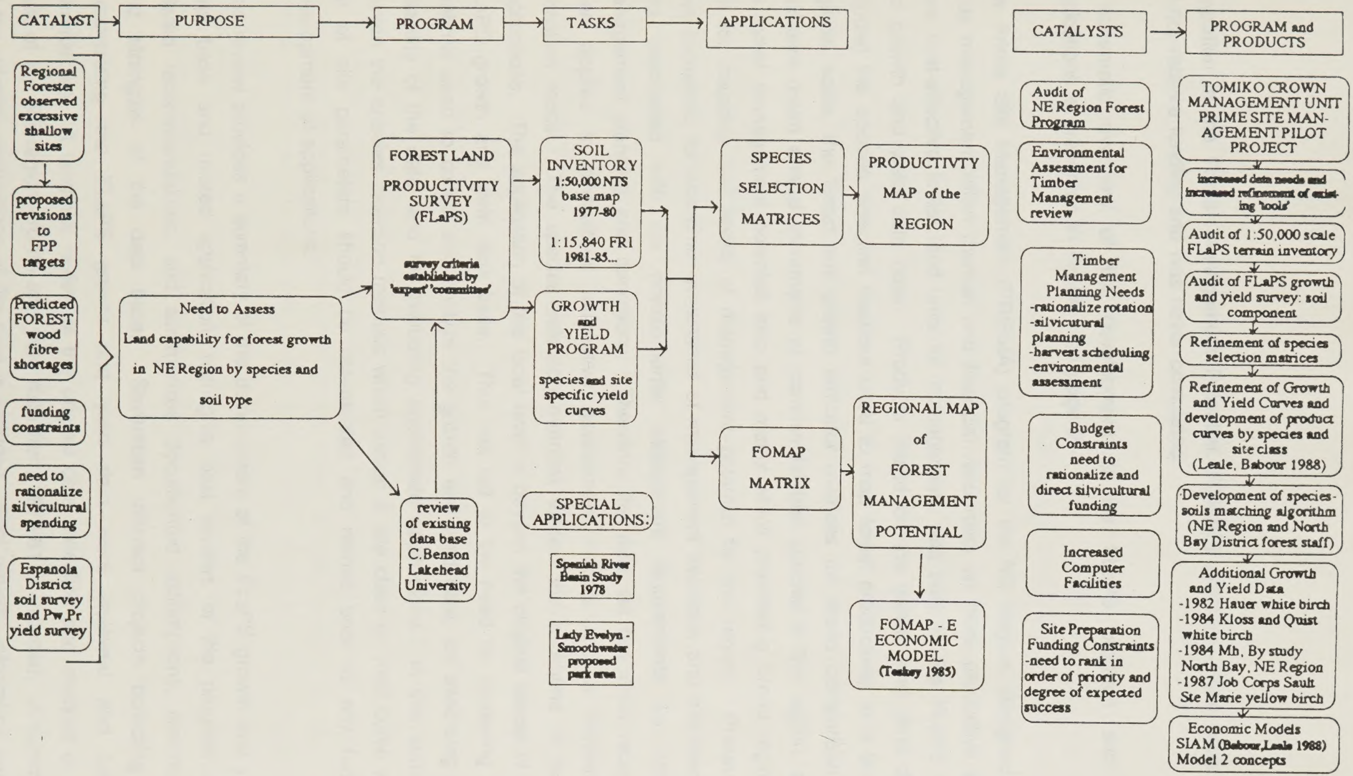
2. the delineation and description of an inventory of homogeneous landform-based terrain units for the region on 114 1:50,000 scale National Topographic Series base maps (completed 1980);

3. the production of soils- and site-related yield tables for major commercial coniferous tree species and poplar found in the region and grouped according to site region (Hills 1952); and,

4. the delineation and description of homogeneous land-based forest soil mapping units on 1:15,840 scale aerial photographs and subsequent mapping for selected areas [produced on 1:20,000 scale Ontario Basic Mapping (O.B.M.) following the designation of this map base for the province].

Additions to the initial surveys were completed as funds and priorities permitted. Additions included an assessment of white birch growth and yield in 1984 with a focus on 'better sites' near the transitional zone between site regions 4E and 5E (Hills 1960). A preliminary stem analysis procedure was initiated in 1984 to develop a methodology for determining a site yield indicator for tolerant hardwoods for

Figure 1. Schematic Summary of the Northeastern Region Forest Land Productivity Survey 1976 to 1988



integration in the Forest Management Potential (FOMAP) program. The program did not receive funding and was never completed.

A schematic overview of the development of the FLaPS program and its applications is presented in Figure 1 on page 2.

The Prime Site Management (PRISMA) program for the NE Region, designed to focus management effort (human and financial resources) on more productive and more cost-effective forest land units for management, was built on the FLaPS soil and growth and yield data base. Products based on the growth and yield data included the species selection matrices used to map forest productivity at a broad regional scale, the forest soil growth indicator matrices for broad comparison of maximum mean annual increments of commercial tree species in the region, and the forest management potential map and matrix which provided a broad regional tool for mapping four levels of management potential for the region. Pressures have increased for economic evaluations of management decisions and site-specific data associated with the environmental assessment requirements for timber management planning and operations. Therefore the data set has most recently been applied in silvicultural alternative assessment models and a harvesting allocation model. The species selection matrices formed the backbone of these applications. The application at this local level is beyond the original scope of the FLaPS growth and yield data base. This has led to the need for reviewing the methods used to collect and analyze the growth and yield data, for assessing the reliability of the data, and for evaluating appropriate applications. In this author's opinion the species selection matrices which assign a site class or yield curve to a set of site parameters should be reevaluated and refined prior to any further development of applications.

This review provides a summary of the development of the FLaPS growth and yield data base and related application, highlights past reviews of the program and related recommendations, and summarizes documented assumptions, limitations, and strengths of the data base. Seventeen different projects collecting or summarizing the FLaPS growth and yield data were reviewed and briefly summarized. A lengthier review of the original data collection and analysis of the bulk of the NE region growth and yield data from 1979-81 is included. A summary of the primary applications of the data is included. Pilot projects integrating growth

and yield matrices with soil data based in geographic applications are excluded from the review.

As indicated the FLaPS program was designed as a 'yardstick' measure of productivity of major commercial tree species in the NE Region by soil type and site region. Soil/site parameters initially selected for describing soil types were mode of deposition, soil texture, soil depth, soil moisture, topography and liminess. Site type was later defined in terms of soil texture, depth and moisture regime. Parameter classes were defined and are documented in the Northeastern Regional Forest Site Evaluation Manual (1988). Initial stem analysis measurements were done manually with a compound microscope and ruler. More recent stem analysis was performed on a digitizer linked to a 'Radio Shack colour computer' and using a provincial TRIM hardware software package.

The primary criticisms of the program which have been highlighted in the past involve the limited data set used to develop the stand density curve and the quality of the original soil data collected at each growth and yield plot. Secondary limitations are listed in the body of the report by project and are summarized in Section 6: Documented Limitations and Recommendations. More recently there have been concerns that data applications are at a local site-specific level beyond the 'design capacity' of the data base.

Studies to test the reliability of predictions based on the data set have been limited in scope and focus. They include the analysis of full plot data to evaluate how well the tree of quadratic mean basal area (used to generate the FLaPS growth and yield tables) represents plot yield. These preliminary results based on a small sample indicated that it was a reasonable indicator of mature stand yield. Both portions and complete sets of the original tree data set have been reanalyzed by several project foresters. Methods for establishing curves through the height-over-age and volume-over-age data and for grouping trees into site classes have varied from a completely manual subjective approach to curve fitting using regression analysis.

Surveys to determine the reliability of the soil data related to the growth and yield data have been conducted to a limited extent. The results from the surveys were never integrated into the computer programs which regrouped data into site classes.

Application models were revised only to a limited extent in response to audit results, because of other priorities.

Staff turnover in the growth and yield program was high. Data and documentation of projects related to the program are scattered. The growth and yield data are currently on file at the Central Ontario Forest Technology Development Unit in North Bay, retrievable from a TRS-80 Model 16 computer. The systems officer is in the process of converting files to askii format. At the time of writing the computer needed repairs and no summary file listings of the existing data set could be generated. Hand-written documentation is scattered in organized and unorganized files, reports in the library (NE Region) and in binder format on book shelves in the NE Regional office. Field data and preliminary computer printouts are filed by species and site region in filing cabinets in the regional office. The bulk of the computer programs used to analyze the data are well documented. They are written in a variety of languages for a variety of computer hardware.

SECTION 6. EXECUTIVE SUMMARY OF DOCUMENTED RECOMMENDATIONS AND LIMITATIONS

Audit of Growth and Yield Soils Data 1984: Recommendations to review all raw soils data associated with each sampled tree and revise the soils data as required. Errors were encountered in soil depth, soil texture and soil moisture regime. Soils and site attributes assigned to each site class should be reviewed and modified as required. The species selection matrices should be revised.

Warren and Wood 1982. Warren and Wood recommended using all trees greater than 8 cm for the calculation of the tree of mean basal area, not just the species of interest. They also noted the need to emphasize freedom from defect in selecting trees. Height percentages and diameters of the nearest five neighbours should be recorded to better estimate competition and to assess the tree of mean basal area.

A revised method for rating moisture regime for very shallow sites should be developed. Ratings using the standard chart for deep soils appeared erroneous. More emphasis should be placed on describing the LFH layers, especially on very shallow sites. The texture of the B horizon and any texture stratifications should be recorded. Stoniness estimates should be improved and standardized. Position on slope should be recorded with more care to document microtopography. A cross-sectional profile of the plot location should be sketched. Moderately dry and fresh moisture regimes should be further refined because they are frequently transitional classes between two height groups.

Kroetsch 1982. The 1982 reworking of the AMIK growth and yield curves identified a weakness in the mortality curves. Stand densities for older stands should be based on statistically sound sampling. He identified a lack of information for white

pine growing on very shallow and deep sites for site region 5E; no data for moist or wet sites, moderately deep fine loams and finer textured soils for red pine in site region 4E, and limited parameter definition for distinguishing site class II and III for red pine in site region 5E.

Collier 1984. Collier reviewed the FLaPS growth and yield procedures in 1984. The reader is referred to his report for a full discussion of the recommended modifications. The three key modifications recommended are plot sampling to replace the selection of individual trees of mean basal area, improved collection of data on soils and ground vegetation, and using the polygon area method for collecting density data in mixed stands.

Collier 1985. In a critique of the FLaPS growth and yield procedures, Collier indicated that the purpose and objectives of the FLaPS growth and yield program should be clearly defined with a stated acceptable probability of error and a stated level of accuracy. The autecology of each species should be clearly understood and staff should be trained well.

Required computing resources, storage space and appropriate analytical software should be defined and acquired for the growth and yield program. Comprehensive documentation of data analysis, data format, and data storage should be mandatory for any further growth and yield work.

He recommends studying the feasibility of using the -3/2 power law for determining stand density in future studies. A mean tree growth model should be developed for each clearly defined site type. The volume-spacing function should be determined for each site type. Spacing should be determined from the growth model and yield

tables produced.

Collier 1985. His reworking of the black spruce data identified many of the limitations noted by earlier workers. In addition he noted the need to collect data on the litter (LFH) layers as it may be a critical factor in determining site class. He also recommended testing the assumption that stands are even-aged before selecting them for sampling using the current growth and yield methods. He also noted the need for improved soil data for each of the plots.

Collier, 1985. In his work on jack pine in site region 3E Collier noted the need to develop a mechanism for dealing with rot in sampled trees. He also recommended using a measure of variability of the mean volume in the stand in FLaPS growth and yield procedures. He also warned of the use of the methods in mixed stands noting that there was no evidence to ensure that the samples would be representative of the volumes which could be supported. Collier reiterated the weakness in the yield functions.

Quist 1984. In this study on birch, no consistent measure of stocking for clumped stands was developed. No understocked stands were represented in the sample, yet conclusions about stocking were made. Reconnaissance data from the Wawa study displayed height differences up to 2 m yet these trees were integrated into the basic data set. These should be removed. Sample distribution was clumped, yet generalized conclusions were made for the region. Many site conditions were not represented in the sampling. The objectives of Quist's study should be confirmed, and should govern the application of its results. Stands were young and yield projections were subjective. Estimates of branch volume were weak.

Kershaw 1989. Species Selection Matrices and Yield Curves: The soil parameters in the species selection matrices should be re-examined. Kershaw (1988) re-examined a sample of the soil attribute assignments in an internal file document which demonstrated the need for revisions. The soil attribute assignments to the current yield curves should be reassessed and redefined. All applications should adopt the revisions. If no revisions are carried out, then the level of reliability and accuracy of the species selection matrices should be clearly defined. The species selected for each soil type in the matrices should be re-evaluated by each District and in some cases for each Management unit if the matrices are to be used for District and Management planning applications. Only the most up-to-date version of the matrices should be retained.

A forest productivity indicator does not account for differences in local site factors. For example it does not account for aspect, position on slope, proximity to a water body and historical factors such as stand development.

The FOMAP matrix is biased towards evaluating the ease of management for artificially regenerated species. It is weak in assessing the ease of management for natural regeneration. It does not take into account the current forest cover in an area, access or markets. It should be re-evaluated and revised if still needed.

The PRODMAPs and the regional FOMAP map should be archived. The data base from which these products were developed is out of date. The algorithm for redefining the FOMAP rating for each FLaPS soil unit was revised by Christilaw in 1988.

Soil/FRI/Species Selection assignment: The soil/FRI matching algorithm should

be redefined for each district or management unit. Initially the changes recommended based on the Tomiko field PriSMa audit should be implemented. Should the algorithm be used as a framework for assigning a NE Region site class for management planning purposes, each district should perform a small field test of the algorithm's output.

Teskey 1985, p. 44. Economic Model: FOMAP-E. Teskey made several recommendations:

i) GMV/GTV ratios: These ratios should be based on pre-adjusted ages to align top/stump ratios with volume rather than age. Where gross total volumes are not available at rotation age from FLaPS volume tables, the volumes should be extrapolated from the appropriate growth curves rather than by using a standard .85 ratio.

ii) FLaPS volumes: Updated volume tables should be used rather than the 1982 version. Where early age classes show no volume, volumes extrapolated by drawing a straight line through the origin should replace values in the model.

iii) Currently the HARVVOL files contain no white spruce prescriptions. They should be added if the model is to be used.

iv) FOMAP ratings should be refined.

v) Red pine prescriptions and volumes were used to estimate tolerant hardwood values. Tolerant hardwood volume tables should be used.

Species prescriptions should be developed for appropriate sites.

vi) The model searches adjacent townships within but not between districts for a FOMAP unit that crosses boundaries.

Leale and Babour 1988. SIAM. These authors identify a number of limitations in various file notes. Of primary concern is the need to re-evaluate the species selection matrices, the soil attributes assigned to each site class and the density curves used to develop the yield curves. They note additional weaknesses including product definition and costing data. The absence of a reliable data set for hardwoods is also discussed.

Date Due

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